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Oropharyngeal cancer

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Abstract

Imaging studies have an important role in defining the extent of oropharyngeal neoplasms and coming to an accurate staging of these lesions. Besides influencing treatment choice, imaging studies can also be used to monitor tumour response to treatment, and as an adjunct to clinical follow-up in order to detect treatment failure as early as possible.

Keywords: *Squamous cell cancer; head and neck; pharynx.*

Introduction

Head and neck cancer commonly originates from the oropharynx. As in most head and neck sites, squamous cell cancer is the most frequently encountered malignant disease. Cigarette smoking and excessive alcohol consumption are well-known risk factors. The accuracy of pre-therapeutic staging is an important factor in the treatment planning of oropharyngeal neoplasms. High-quality imaging is of considerable help to the clinician examining patients with oropharyngeal cancer, by revealing submucosal tumour spread and detecting subclinical adenopathies.

Squamous cell carcinoma

About 90% of oropharyngeal neoplasms are squamous cell carcinoma. Most patients complain of sore throat, otalgia or dysphagia; more advanced, invasive tumours may cause severe pain and trismus.

The T-staging is based on tumour size, and involvement of adjacent structures (Table 1). The most common site of origin of oropharyngeal cancer is the anterior tonsillar pillar.

Tonsillar cancer

Nearly all tonsillar cancers originate from the anterior tonsillar pillar. These cancers commonly spread anteroinferiorly to the tongue base, and superomedially to the soft palate, both along the palatoglossal muscle. Anterolateral spread, along the pharyngeal constrictor muscle to the pterygomandibular raphe and retromolar trigone, is also often seen (Fig. 1). Advanced lesions may invade the mandible, spread along the pharyngeal wall to the hypo- and/or nasopharynx, or invade the parapharyngeal space through the pharyngeal wall. Spread to the infratemporal space, with involvement of the muscles of mastication and neurovascular structures in this space may be seen in advanced cases.

Lesions originating from the posterior tonsillar pillar are rare; these may spread inferiorly along the palatopharyngeal muscle.

Tongue base cancer

Cancer in the tongue base tends to grow silently and deeply, and is often larger than suspected at clinical examination. Tumours may spread, along the palatoglossal muscle, cornering the glossotonsillar sulcus, to involve the anterior tonsillar pillar.

Anterior spread into the floor of the mouth and/or tongue body may occur, along the mylo- and/or hyoglossal muscle, and/or along the lingual neurovascular bundle (Fig. 2). Tongue base cancer may also grow in a retrograde fashion along the lingual vessels towards the external carotid artery[1]. Vascular and perineural tumour spread is associated with reduced local and

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regional tumour control and reduced patient survival. A tumour mass with a overall diameter of more than 2 cm on imaging predicts vascular and perineural tumour spread[2]. Infiltration of the normal fatty tissue planes in the base of the tongue, of the fat in the sublingual space, as well as irregular tumour margins are also associated with an increased risk of vascular and perineural tumour spread. Such findings are related to overall tumour bulk.

Spread to the valleculae and piriform sinuses, and into the pre-epiglottic space may be seen. Extension of a tongue base cancer across the midline usually precludes surgical cure, as one lingual neurovascular pedicle needs to be conserved for sufficient functional recovery to allow safe swallowing.

Table 1 T-staging of oropharyngeal carcinoma[12]

Tis	Carcinoma *in situ*
T1	Tumour ≤2 cm in greatest dimension
T2	Tumour >2 cm but ≤4 cm in greatest dimension
T3	Tumour measures >4 cm in greatest dimension
T4a	Tumour invades any of the following: larynx, deep/extrinsic muscle of the tongue (genioglossus, hyoglossus, palatoglossus, and styloglossus), medial pterygoid, hard palate, and mandible
T4b	Tumour invades any of the following: lateral pterygoid muscle, pterygoid plates, lateral nasopharynx, skull base, or encases the carotid artery

Differentiation of tongue base cancer from normal lymphoid tissue on the surface of the tongue base may be difficult on imaging studies; the only reliable criterion to diagnose cancer is infiltration of the deeper soft tissue structures.

Soft palate cancer

Soft palate cancer may spread laterally and inferiorly along the tonsillar pillars. Superior spread to the nasopharynx occurs in advanced disease (Fig. 3). Carcinoma of the soft palate may occasionally spread perineurally along palatine branches of the maxillary nerve[3].

Posterior oropharyngeal wall cancer

Isolated cancer in the posterior oropharyngeal wall is rare (Fig. 4); more commonly, this wall is invaded by cancers originating from the lateral oropharyngeal wall. Along the posterior wall, mucosal or submucosal spread to the hypopharynx and/or nasopharynx is possible.

Fixation to or direct invasion of the prevertebral fascia precludes the possibility of surgical resection of pharyngeal cancer, and is associated with a poor prognosis. The absence of pre-vertebral space involvement is reliably predicted on CT and MR images by demonstrating the preservation of the retropharyngeal fat plane. The negative predictive value of this sign varies between 82% and 97.5%[4,5]. However, cross-sectional imaging is poor in predicting involvement of the pre-vertebral space. Obliteration of the retropharyngeal fat plane, asymmetric enlargement of the pre-vertebral muscles (on CT studies), and thickening and signal abnormalities (on MR studies) are all unreliable signs to diagnose extension into this space (Fig. 4)[4–6]. Open neck exploration with direct evaluation of the pre-vertebral muscles is superior to CT and MRI and should be considered in these patients. However, the decision to perform surgical resection in these patients is influenced by a number of factors in addition to involvement of the pre-vertebral space, including carotid artery encasement, perineural spread, retropharyngeal adenopathy and overall patient performance status. Also, the majority of lesions on the posterior pharyngeal wall are treated by radiotherapy or combined chemotherapy and radiotherapy, as the reported cure rates are similar to those of surgery alone or combined surgery and radiotherapy[7]. Nevertheless, as surgical reconstruction methods improve, resection with postoperative radiotherapy can be considered in selected cases[8].

Lymphatic spread

Lymphatic spread usually occurs in a predictable way, from superior to inferior, the upper parajugular lymph nodes (level II) being the first echelon at risk. Retropharyngeal adenopathy is relatively common and usually associated with lymphadenopathy in other neck levels; isolated retropharyngeal adenopathy without involvement of other lymph nodes also occurs, particularly in posterior oropharyngeal wall cancer. Bilateral adenopathies are commonly seen in soft palate cancer, as well in base of the tongue cancer.

Treatment and posttreatment imaging

Oropharyngeal cancer is treated with curative intent by radiotherapy, surgery or a combination of both modalities. Depending on anatomical localisation, small lesions (T1 or T2) are treated by either radiotherapy or surgery; cancer of the soft palate or uvula is treated by irradiation, as surgery of these structures interferes with palatal function. Larger lesions (T3 or T4) are, if possible, surgically treated, with postoperative radiotherapy. Inoperable oropharyngeal cancer is treated by concomitant chemoradiotherapy.

Although currently no hard data are available on the value of surveillance imaging for oropharyngeal cancer after radiotherapy, obtaining a baseline follow-up CT or MR study 3–6 months after the end of therapy can be considered. In a number of cases, local failure can be detected at an earlier stage than by clinical examination alone. Persisting or recurring tissue asymmetry and/or increased tissue enhancement after therapy, are suspect for persisting or recurring tumour (Fig. 5). Such findings

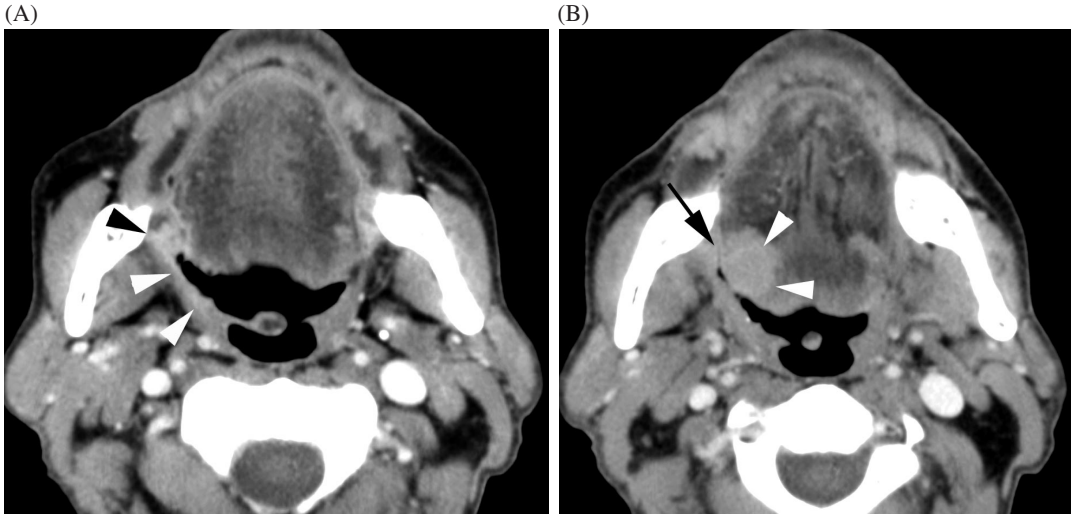

Figure 1 **Axial contrast-enhanced CT images in a patient with right-sided tonsillar cancer. (A) Soft tissue thickening and increased enhancement in the right anterior tonsillar pillar (white arrowhead), extending to the pterygomandibular raphe (black arrowhead). (B) The enhancing soft tissue mass grows along the glossotonsillar sulcus (arrow) into the tongue base (arrowheads).**

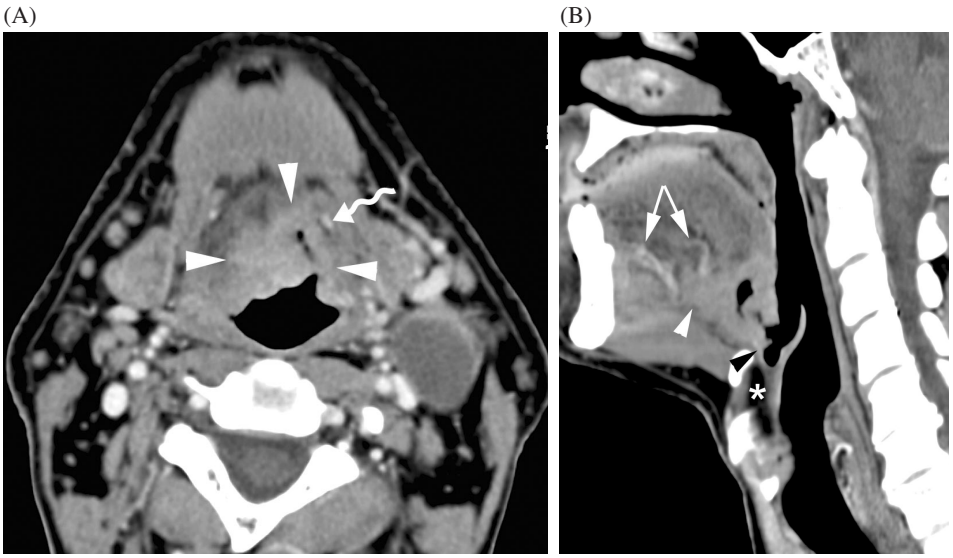

Figure 2 **Contrast-enhanced CT images in a patient with tongue base cancer. (A) Axial image. Ulcerated, contrast-enhancing soft tissue mass in the base of the tongue (arrowheads). Irregular tumour margins are present. The lesion crosses the midline, and approaches the left lingual artery (curved arrow). A large adenopathy is present on left side. (B) Sagittal reformatted image (left paramedian section). Anterior spread in the floor of the mouth (white arrowhead); again, close relationship to the proximal part of the lingual artery is seen (distal branches indicated by arrows). The lesion extends into the vallecula (black arrowhead); the preepiglottic space (asterisk) is not involved.**

need further exploration; when no clinical correlate is apparent, it is safe to perform an additional nuclear imaging study or to obtain a follow-up CT/MR study about 4 months later. In case of persisting or progressive tissue changes, tissue sampling is required.

When an oropharyngeal cancer is treated primarily by surgery, often extensive removal of soft tissues, and possibly also mandibular bone is needed to obtain oncologically safe resection margins. To reconstruct the created tissue defects, and to obtain a better functional

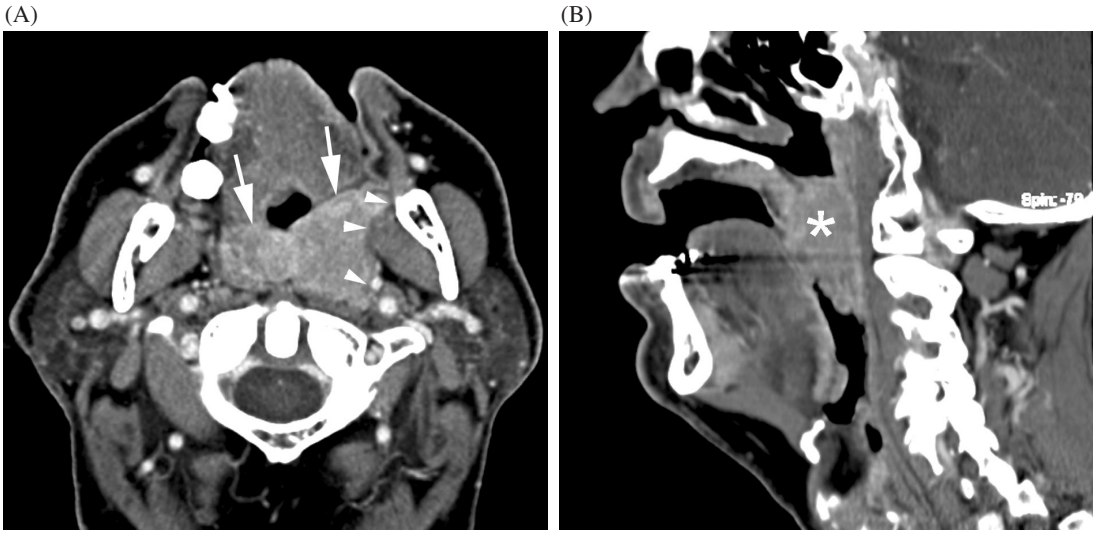

Figure 3 **Contrast-enhanced CT images in a patient with soft palate cancer. (A) Axial image. Pronounced thickening and increased enhancement of the soft palate (arrows); extension is seen into the retromolar trigone; the left lateral pharyngeal wall is displaced towards the parapharyngeal space (arrowheads). (B) Sagittal reformatted image; the soft palate tumour is indicated by an asterisk.**

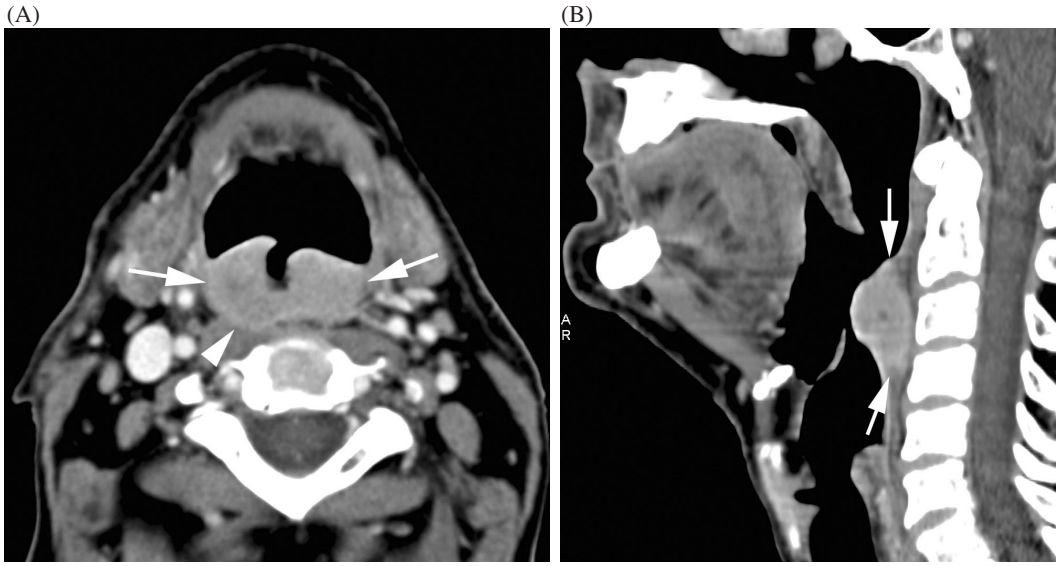

Figure 4 **Contrast-enhanced CT-images in a patient with cancer of the posterior oropharyngeal wall. (A) Axial image. Contrast-enhancing soft tissue mass (arrows), showing ulceration. On the right side, the lesion obliterates the retropharyngeal fat plane and reaches the pre-vertebral muscle (arrowhead); invasion of this muscle cannot be excluded. (B) Coronal reformatted image, showing the craniocaudal extent of the lesion (arrows).**

and/or cosmetic result, tissue transfer from a body donor site to the oropharyngeal region may be required. These flaps are vascularized by local vessels, anastomosed to the flap by microvascular techniques. Different kinds of free flaps are in use, for example cutaneous flaps to reconstruct defects in the oropharyngeal cavity, or osseous flaps (e.g. fibula) to reconstruct mandibular defects. A CT or MR study, obtained about 4 months after the end of such a complex procedure, may be helpful as a baseline study allowing earlier diagnosis of subsequent tumour recurrence.

Other neoplastic disease

Non-Hodgkin's lymphoma

Due to the abundant lymphoid tissue in the oropharynx (lingual and palatine tonsils), non-Hodgkin's lymphoma

occurs in this region as extranodal lymphatic disease. The diagnosis of lymphoma can often be suggested based on the imaging findings, as these tumours frequently appear large and homogenous on imaging studies. Also, adenopathies may be present at sites unusual for an untreated carcinoma, or the oropharyngeal lesion may be associated with another extranodal neck lymphoma localisation[9,10]. Such findings, occurring in patients with no risk factors for head and neck carcinoma, are suggestive for lymphoma.

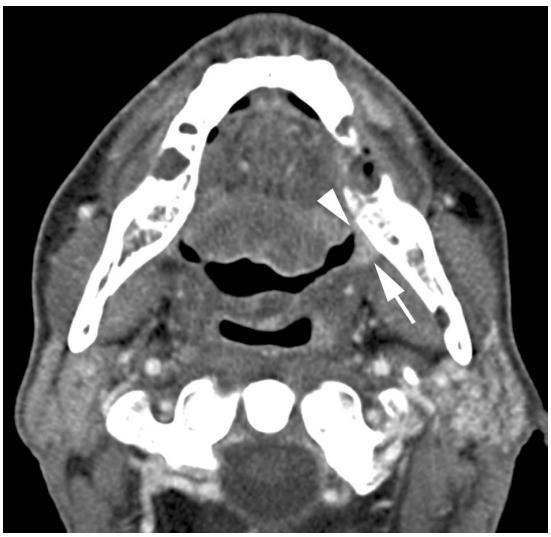

Figure 5 **Axial contrast-enhanced CT image, obtained 6 months after completion of radiotherapy for oropharyngeal cancer, because of left sided odynophagia and otalgia. Slight soft tissue thickening and increased enhancement is seen in the left anterior tonsillar pillar (arrow) extending into glossotonsillar sulcus (arrowhead). Clinically, this abnormality corresponded to a small granulomatous lesion. Biopsy revealed squamous cell cancer.**

Salivary gland tumours

These oropharyngeal neoplasms originate from minor salivary glands. In the soft palate, these are often benign pleiomorphic adenomas, but in other oropharyngeal sites malignant tumours, such as mucoepidermoid and adenoid cystic carcinoma, predominate[11].

Conclusion

The clinical examination and imaging studies are complementary in precisely evaluating oropharyngeal tumour extent and staging the lesion. As an adjunct to clinical surveillance, imaging can be used to monitor tumour response and to detect recurrent or persistent disease as early as possible.

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